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<b>To:</b>	Project Team Members	<b>Date:</b>	03/13/02
<b>From:</b>	Montgomery Watson Harza	<b>Reference:</b>	02/21/02 Bosque and Leon Rivers Watershed Study Conceptual Site Model Workshop
<b>Subject:</b>	Meeting Notes		

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The following is a “final” copy of the meeting notes from the events and issues discussed during the Conceptual Site Model (CSM) workshop held at MWH’s office in Dallas, Texas on February 21, 2002. The topics are organized in the same order as the meeting agenda, which is listed below.

**Attendees:**

United States Army Corps of Engineers, Fort Worth District (USACE) – Brian Condikey, Wayne Elliott  
Brazos River Authority (BRA) - Mike Meadows, Kyle Headley, Rob Fuentes  
Montgomery Watson Harza (MWH) – David Ebersold, Bruce Narloch, Ron Hartline, Brad Wolaver, Kartik Gandhi  
The Institute of Environmental and Human Health at Texas Tech University (TIEHH) – Dr. Todd Anderson, Dr. Phil Smith  
Baylor University (Baylor) – Dr. Joe Yelderman, Dr. Owen Lind  
City of Killeen – Bruce Butscher

**Agenda:**

- I. Project Introduction – Mr. Brian Condikey
- II. Introduction of Meeting Attendees
- III. Meeting Objectives – Mr. Ron Hartline
- IV. General Conceptual Site Model Discussion – Mr. Bruce Narloch
- V. Data Gaps Discussion and Prioritization – Mr. Bruce Narloch
- VI. Detailed Data Gap/General Cost Discussion – Mr. Bruce Narloch
- VII. Value of Information Analysis Discussion – Mr. Bruce Narloch
- VIII. Develop Action Items – Mr. Bruce Narloch
- IX. Adjourn Meeting

**Questions and Answers:**

Mr. Condikey stated that the purpose of this meeting is to discuss the CSM developed by MWH to understand the data gaps that need to be filled by our project team and better understand potential environmental exposure.

The meeting attendees then introduced themselves.

Mr. Hartline then discussed the goal of the project and specific objectives of the meeting.

*The goal of the project is “to evaluate human and environmental exposure in Lake Belton and Lake Waco study area.” Additional meeting objectives are as follows:*

- *Understand the CSM and refine based upon this discussion*
- *Address listed data gaps*
- *Conceptualize a Scope of Work for filling data gaps*
- *Determine due date for the incorporation of revisions to draft CSM document*
- *Determine if a modeling effort is necessary and if so, determine a scope of work and start date*

**Mr. Bruce Narloch then conducted a presentation summarizing all available soil, surface water (streams and lakes), stormwater, sediment and groundwater perchlorate sampling results. The maps discussed included a compilation of analytical data obtained during sampling conducted by the Navy/ EnSafe, TIEHH and the Texas Natural Resources Conservation Commission (TNRCC).**

**The following is a summary of the discussion that followed:**

- Dr. Yelderman inquired about the detection limits for sampling efforts.  
Mr. Narloch responded that the detection limits are listed for each sample point in the Draft CSM appendices. He also indicated that the final GIS would have all the sample results and associated detection limits.
- Mr. Meadows indicated that the CSM report should indicate that all the water quality and sediment sampling were not complete. The CSM only includes available sampling data from various sources up to a specific point in time. BRA will be conducting more sampling depending on the outcome of the CSM. Also, TIEHH and the Navy will be conducting more sampling which will need to be incorporated later in the study. He also noted that the NWIRP boundary shown on the maps might not be up-to-date.
- Mr. Ebersold noted that storm water sampling conducted by the Navy did not indicate the source of perchlorate. It could not be determined whether the perchlorate came from surface water or was flushed out of groundwater (due to storm events).
- Dr. Yelderman suggested that the direction of the groundwater flow might be perpendicular to the strike beds east of NWIRP, hence groundwater beneath this area might not contribute to stream flow closer to NWIRP but instead may reach the streams further down the stream course and lower in the watershed. Consequently, it is possible that there is an uncharacterized mass of perchlorate in groundwater east of the facility that is not interacting with the streams yet. Furthermore, Dr. Yelderman indicated that perchlorate concentrations in streams (taken at baseflow) and shallow dry wells might both actually be indicative of the perchlorate concentrations of shallow groundwater. He saw a need to obtain gauge and precipitation records to separate out baseflow to determine if and to what extent shallow groundwater discharge contributed to stream flow.
- Mr. Narloch discussed the perchlorate “hit” downstream of the Lake Belton dam and suggested that there could be another source of perchlorate in the watershed, namely, the Fort Hood military installation.

Mr. Fuentes said that the Blacklands Research Center was carrying out sediment sampling at Cowhouse Creek, which could be beneficial to the study. However, the sampling carried out was mainly to determine nutrient loading and did not include water quality sampling for perchlorate.

- Dr. Lind said that there was a possibility that the waters of Lake Belton (originating from Station Creek and the Leon River) could back up towards the west, hence causing sedimentation detects in Lake Belton. He also suggested that the sediment detects may be due to organic deposits.  
Mr. Meadows indicated that there was an inadequate understanding of sediment deposition and scouring in the reservoir and this constituted a significant data gap.

- Mr. Narloch brought out the following points regarding sediment sampling. He indicated that perchlorate is not highly charged and does not readily adsorb to sediment particles. Moreover, perchlorate is highly soluble and preferentially partitions to water. He suggested that pore water samples would be a better indicator of perchlorate compared to bulk sediment sampling.
- Mr. Meadows suggested adding the intake structures to the CSM report maps.

Following Mr. Narloch's presentation, these related issues were discussed in detail:

### **Fate and Transport**

Irrigation – Mr. Meadows stated that there is no significant agricultural irrigation within the watersheds. Dr. Yelderman said that the watering of lawns is probably the primary irrigation issue and probably utilizes water from the deeper Trinity aquifer, in lieu of surface waters impacted by perchlorate. He continued that the irrigation of fruits/vegetables, from stock ponds and hand-dug wells may occur to a limited extent. He also pointed out that a bench scale cation exchange study should be carried out using local soil instead of generic media.

Cation exchange capacity – Mr. Narloch indicated that the tendency for perchlorate to undergo cation exchange in the environment was unknown.

Surface Water Density - Dr. Yelderman believes that density may be a relevant factor in hydrologic stratification. Mr. Ebersold questioned whether or not this may be the cause of observed perchlorate concentrations in sediment pore water when relatively little is detected in above-sediment surface water.

Additonal Groundwater and Surface Water sampling – Dr. Yelderman said that he believed the groundwater interacts with the surface water away from the plant, and recommended additonal sampling of surface water and groundwater at the South Bosque trunk basin and other neighboring tributaries. This procedure would help detect perchlorate, which may have migrated from groundwater to surface water.

### **Biological Uptake and Transformation**

Dr. Anderson discussed in detail the work carried out by TIEHH and the plans for future work. Dr. Anderson's presentation discussed the following items:

#### Current work carried out by TIEHH:

- Sampling of aquatic organisms, including frogs, fish, and other organisms, in three areas (Station Creek, Harris Creek, and the tributaries of the S. Bosque River draining NWIRP),
- Residue analysis on tissues (Thyroid histology),
- Collect and analyze water samples from three areas using EDSTAC endocrine disruptor tests,
- Tests on terrestrial (small mammals), avian species (mourning doves) etc.,
- Sampling of sediment, water, plants etc., and
- Tests on fillets of fish

The goal of the current work is to help characterize exposure.

#### Future work planned by TIEHH:

- Continuation of previous work,
- Collect and analyze blood samples,
- Thyroid hormones and histology tests,
- Enclosure studies, and
- Modeling

The goal of this future work is to determine what species are being exposed.

## **Investigation Strategy**

Dr. Lind indicated that perchlorate would distribute more uniformly in Lake Waco than in Lake Belton. Building on that assumption, Mr. Ebersold noted that it would be easy to evaluate perchlorate concentrations in water quality samples from Lake Waco if we understand the following parameters:

- (1) flow rates of tributaries,
- (2) concentrations of perchlorate in tributaries, and
- (3) groundwater flows and velocities.

Dr. Lind confirmed that it should be easier to assume distribution patterns in Lake Waco than in Lake Belton. However, he did qualify that surface water in the northern portion of Lake Waco receives a strong influence by the North Bosque River (which is not impacted by perchlorate contamination). Dr. Lind also proposed that South Bosque water may be held back from the drinking water intakes at certain times of the year by the strong southwest push of the N. Bosque.

Mr. Ebersold suggested that measurements of flow (F), concentration (C), and time (T) could be made just upstream of the point of discharge of the S. Bosque to Lake Waco to estimate the effect of the S. Bosque watershed on perchlorate input to Lake Waco.

Mr. Narloch suggested that it may be important to obtain groundwater measurements in order to evaluate the relative influences of groundwater versus surface water to the total input to Lake Waco and also to predict future flow of perchlorate into the Lake originating from groundwater contamination at NWIRP.

Mr. Meadows brought up the fact that irrigation water is obtained from just below the discharge of the S. Bosque into Lake Waco by the Heather Run Golf Course and Ridgewood Golf Course and indicated that water quality sampling should be conducted at these sites.

Dr. Lind said that the discharge of N. Bosque was greater than the discharge for S. Bosque. Along with discharge characteristics, the fact that Lake Waco has two arms makes Lake Waco easier to evaluate. He then said that Lake Waco was comparatively well mixed, while Lake Belton was well stratified. He also stressed the need to study the effects of the old Lake Waco dam on bottom current flows and the movement of sediment.

Dr. Yelderman said that the contribution of groundwater to Lake Waco was minimal.

After much discussion, the following action items were decided upon:

## **ACTION ITEMS**

### **LAKE WACO (Assuming relatively more mixed compared to Lake Belton)**

- Conduct longitudinal measurements of flow (F), concentration (C), and time (T) immediately upstream of the confluence of the S. Bosque River with Lake Waco.
- Conduct a mixing/homogeneity study within Lake Waco.
- Conduct sediment sampling within the delta area (sampling of pore water or bulk sediment).
- Conduct surface water sampling at the drinking water intakes (Heather Run and Ridgewood Golf Courses).
- Conduct targeted fish collection within the delta area.

### **NWIRP TO LAKE WACO (Harris Creek, South Bosque River, Station Creek)**

- Conduct surface water and groundwater sampling on the S. Bosque River to better understand surface water-groundwater interactions.
- Groundwater fluctuations (water level and water quality) related to storm water events (measured at 6-9 groundwater monitoring wells along tributaries)
- Conduct surface water and groundwater sampling at two locations each on Station Creek, Harris Creek, and tributaries to the S. Bosque River.

- Conduct nitrate monitoring in surface water and groundwater to evaluate potential inhibition of perchlorate uptake by nitrate in plants.
- Collect storm water flow measurements at NWIRP.
- Conduct longitudinal surface water concentration/flow measurements.
- Perform aerial color infrared satellite analysis to identify seeps and springs (USACE will determine if LANDSAT thermal images may be used to delineate locations in trial run).
- Collect rainfall data.
- Conduct shallow groundwater studies (Dye tests)

#### **LAKE BELTON (Assuming occasional stratification)**

- Perform surface water studies necessary to develop an improved conceptual hydrodynamic model.
- Investigate the potential influence of Ft. Hood.
- Perform targeted water quality and sediment sampling.
- Study potential sediment influences (i.e., to better understand whether sediment acts as a sink or source of perchlorate).
- Evaluate potential preferential migration pathways of Station Creek water in Lake Belton.
- Design studies to better understand interactions between algal communities and perchlorate within the lake.
- Evaluate the importance of the anoxic component of Lake Belton on perchlorate reductive metabolism and fate. Use a bench-top study to evaluate whether or not it occurs, and hydrodynamic measurements to estimate the volumes of anoxic water in the lake.

#### **NWIRP TO LAKE BELTON**

- Conduct the longitudinal surface water, flow, and groundwater studies described for the Lake Waco watershed.
- Conduct studies to understand the mixing of Station Creek with Leon River.
- Study potential impact on receptors.

#### **BIOLOGICAL/ ECOLOGICAL**

- Study terrestrial plants and floodplain soils

#### **MISCELANEOUS**

- Study perchlorate concentration in floodplain soils
- Study effects on stock ponds and dug wells
- Conduct studies to gain a better understanding of the vertical distribution of perchlorate in groundwater

#### **SCHEDULE**

- MWH to complete and submit a draft scope of work (SOW) to the USACE by March 11, 2002.
- USACE to complete its review by March 18, 2002.
- USACE to issue delivery order by March 25, 2002.
- Comments on Draft CSM to be submitted to MWH by March 11, 2002.